

counties. Following is a description of the storm in Yankton County, by Mr. Henry G. B. Swinhoe, station agent, Weather Bureau, Yankton, S. Dak.:

I have the honor to report that a hailstorm of great severity occurred in this locality yesterday (July 26), doing an immense amount of damage, estimated in this county alone at \$100,000. The path of the storm included the best farming section of the county, from Lesterville on the west to Gayville on the east, and varying in width from 5 to 10 miles. This portion is practically laid waste, a few spots being less seriously damaged. The crops were beaten into the ground, the leaves and branches were stripped from the trees, and numbers of hogs and chickens were killed. Probably a small portion of the oats, which were in shock, may be saved; but the wheat, standing in the field, is completely destroyed where the hail occurred, and the thousands of acres of fine corn are now reduced to leafless stumps. The crops were the best that have been raised here for the last five or six years, and the loss to many of the farmers will be irreparable. Many specimens of hailstones and broken corn stalks were brought in by farmers this morning. Some of the stones measured  $1\frac{1}{2}$  inches in diameter sixteen hours after they had fallen; they were of very rugged appearance. Farmers from the worst part of the storm report a sea of ice and mud many miles in extent, the hail in the ravines being 2 feet in depth. The storm appeared to travel from east to west several miles north of Yankton during the forenoon of Sunday, the atmosphere being very sultry, and a light breeze from the southeast. The storm appeared to remain stationary in the northwest till between 2 and 3 p. m., when it commenced to approach, and at the same time divided into two parts, one going south into Nebraska, and the other going east, at about 4 miles north of Yankton. This station, lying between the two main parts of the storm, received 0.74 of an inch of rain, and a maximum wind velocity of 38 miles per hour. No hail fell here, and no damage was done. The temperature was highest (86.9°) about one hour before the storm; during the storm the temperature fell to 64.5°. The color of the clouds in the distance was an inky black, changing on a near approach to a dark green, while the roar of the hail sounded at this station like distant thunder. I am told that some of the hailstones weighed 1 pound, twenty hours after the storm. They were composed of a number of very hard lumps of ice about one-half inch in diameter each, held together by soft ice, forming a mass sometimes 3 inches in diameter. Large holes were made through shingle roofs, and the overhanging eaves of buildings were chipped off.

In Iowa, Nebraska, and South Dakota crops were also damaged by wind, rain, and hail. The storm was unusually severe in Marshall Co., Iowa. At St. Anthony, Albion, and Green Mountain a number of buildings were wrecked. One person was severely injured at Albion. The property loss will probably aggregate \$10,000. The greatest damage by hail in Iowa was in Ida, Sac, and Cherokee counties. Severe local storms occurred in southern Michigan, the destruction being greatest in the vicinity of Homer, Three Rivers, Battle Creek, and Northville; other points also suffered.

27th.—The 26th and 27th were days of unusual storm frequency. Iowa, Wisconsin, and Michigan were visited by severe local storms on the 26th, and Indiana, Illinois, Ohio, Pennsylvania, Maryland, New Jersey, and New York on the 27th. These storms seemed to develop simultaneously over large areas, although a progressive movement from west to east was noticed in some cases. The storms in Ohio and western Pennsylvania were unusually severe. At Columbus, Ohio, buildings were unroofed and otherwise damaged by the wind. At Pittsburg, Pa., 2 persons were killed and 7 injured. The damages by wind and flood were very great. The storms did but little damage in central Pennsylvania, but throughout the eastern portion of the State and in New Jersey they were quite severe. An incipient tornado cloud was seen at Gibson City, Ill.; the funnel did not reach to the earth.

28th.—Hail of great size fell in and about Montpelier, Ind., damaging crops and killing live stock.

29th.—A minor tornado occurred at Gloucester, Ohio, at 7.55 p. m., central time. One person was killed and 10 were injured. Property loss about \$4,000. The storm moved northeast then southeast in a path 150 yards wide and  $1\frac{1}{2}$  miles long. A severe wind and thunderstorm, in which the wind was said to have a whirling motion counter clockwise, occurred at Huntington, Ind. Three persons were injured. The storm's path was very irregular; it was reported as mov-

ing first from west to east, then southeast and finally northeast; its path was from one-quarter to one-half mile wide and 15 miles long. Property loss (buildings only) probably not over \$3,000. A destructive hailstorm originated in the central part of Edmunds Co., S. Dak., near Ipswich; passing southeast, destroying the crops and breaking the glass in a great number of windows in its course to the eastern part of Spink County. The path of greatest destruction was about 5 miles wide and 20 miles long.

Casualties during the month by lightning, 87.

#### TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

The mean temperature is given for each station in Table II, for voluntary observers. Both the mean temperatures and the departures from the normal are given in Table I for the regular stations of the Weather Bureau.

The *monthly mean temperatures* published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II.

The *regular diurnal period* in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The *distribution of the observed monthly mean temperature* of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau Region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The *highest mean temperatures* were: Yuma, 91.3; Phoenix, 88.0; Shreveport and Fort Smith, 84.6; Little Rock, 84.2; Galveston, 83.6; San Antonio, 83.4; Palestine, 83.4; New Orleans, 82.8; Savannah and Port Eads, 82.6; Charleston and Memphis, 82.4; Key West, 82.3. The lowest mean temperatures were: Tatoosh Island, 57.0; Fort Canby, 61.2; Eastport, 62.2. Among the Canadian stations the highest were: Spences Bridge, 74.6; Medicine Hat, 70.2; Toronto, 68.2; Port Stanley, 68.0; Kingston, 67.4. The lowest were: Father Point, 58.0; Banff and Esquimaux, 58.6.

As compared with the normal for July the mean temperature for the current month was in excess in portions of the lower Lake Region and south Atlantic Coast, as also over New England, the northern Plateau Region and Missouri Valley. It was deficient especially in the northern and southern Slope and Pacific Coast Region. The greatest excesses were: Roseburg, 4.8; Calgary and Spokane, 4.2; Walla Walla, 3.9; Sacramento, 3.3; Chatham, 3.2; Baker City, 3.1; Swift Current and Fresno, 2.8; Medicine Hat, 2.7. The greatest deficits were: El Paso, 4.2; Williston, 2.6; Omaha, 2.5; Santa Fe, 2.4; Jupiter, 2.3; Huron and Sioux City, 2.2.

Considered by districts the mean temperatures for the current month show departures from the normal as given in Table I. The greatest positive departures were: Northern Plateau, 3.3; north Pacific, 2.3; middle Pacific, 2.2. The greatest negative departures were: Florida Peninsula, 2.0; southern Plateau, 2.1.

The *years of highest and lowest mean temperatures* for July are shown in Table I of the REVIEW for July, 1894. The mean temperature for the current month was the highest on record at: Fresno, 85.5; Fort Smith, 84.6; Little Rock, 84.2; Walla Walla, 79.1; Sacramento, 76.5; Winnemucca, 73.4; Spokane, 73.2; Roseburg, 71.3; Idaho Falls, 69.6; Carson City, 69.3; Astoria, 64.1; Fort Canby, 61.2; Port Angeles, 58.9. The mean temperature for the current month

was not the lowest on record at any regular station of the Weather Bureau.

The *maximum and minimum temperatures* of the current month are given in Table I. The highest maxima were: 110, Yuma (frequently); 109, Phoenix and Redbluff (9th); 106, Walla Walla (15th); 104, Sacramento (9th); 103, Fort Smith (28th), Little Rock (31st), Bismarck (11th). The lowest maxima were: 67, Point Reyes Light (frequently); 70, Tatoosh Island (21st), Port Angeles (19th), Eureka (31st); 72, San Francisco (9th). The highest minima were: 73, Galveston (11th); 72, Port Eads and Key West (7th), Corpus Christi (frequently); 70, Charleston (9th), Savannah and Jacksonville (7th), Pensacola (8th), New Orleans (1st). The lowest minima were: 38, Williston (22); 40, Havre (24th); 41, Pysht (3d); 43, East Clallam (1st) and Bismarck (22d).

The *years of highest maximum and lowest minimum temperatures* are given in the last four columns of Table I of the current REVIEW. During the present month the maximum temperatures were the highest on record at: Bismarck and Little Rock, 103; Meridian, 102; Memphis, 101; Pensacola, 99. The minimum temperatures were the lowest on record at: Williston, 38; Jupiter, 68.

The *greatest daily range of temperature and data for computing the extreme and mean monthly ranges* are given for each of the regular Weather Bureau stations in Table I. The largest values of the greatest daily ranges were: San Luis Obispo, 45; Idaho Falls and Winnemucca, 44; Havre, 43; Carson City, 42; Miles City, 41; Fresno, 40. The smallest values were: Woods Hole and Galveston, 13; Corpus Christi and Jupiter, 14; Key West and Hatteras, 15; Port Eads and Block Island, 16; Nantucket, 17; San Diego, 18; Charleston, Pensacola, Eureka, Fort Canby, and Point Reyes Light, 19; Tampa, Mobile, San Francisco, and Tatoosh Island, 20.

Among the *extreme monthly ranges* the largest were: Denver, 66; Bismarck, 60; Havre, 58; Walla Walla, Carson City, and Fresno, 55; San Luis Obispo, Winnemucca, Williston, and Miles City, 54. The smallest values were: Corpus Christi, 18; Port Eads, 10; Point Reyes Light, 21; Key West, San Francisco, Tatoosh Island, and Woods Hole, 22.

The *accumulated monthly departures* from normal temperatures from January 1 to the end of the current month are given in the second column of the following table, and the average departures are given in the third column for comparison with the departures of current conditions of vegetation from the normal condition.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Total.	Average.		Total.	Average.
Middle Atlantic.....	+ 2.6	+ 0.4	New England.....	- 0.6	- 0.1
South Atlantic.....	+ 8.1	+ 1.2	Florida Peninsula.....	-11.7	- 1.7
West Gulf.....	+ 8.6	+ 1.2	East Gulf.....	- 0.9	- 0.1
Ohio Valley and Tenn.....	+ 9.0	+ 1.3			
Lower Lake.....	+ 9.5	+ 1.4			
Upper Lake.....	+20.5	+ 2.9			
North Dakota.....	+ 8.1	+ 1.2			
Upper Mississippi.....	+19.9	+ 2.8			
Missouri Valley.....	+19.3	+ 2.8			
Northern Slope.....	+ 9.8	+ 1.4			
Middle Slope.....	+21.9	+ 3.1			
Abilene (southern Slope).....	+21.4	+ 3.1			
Southern Plateau.....	+ 5.6	+ 0.8			
Middle Plateau.....	+ 3.0	+ 0.4			
Northern Plateau.....	+15.9	+ 2.3			
North Pacific.....	+ 1.4	+ 0.2			
Middle Pacific.....	+ 1.4	+ 0.2			
South Pacific.....	+ 6.0	+ 0.9			

#### MOISTURE.

The *quantity of moisture* in the atmosphere at any time may be expressed by the weight of the vapor coexisting with the air contained in a cubic foot of space, or by the

tension or pressure of the vapor, or by the temperature of the dew-point. The mean dew-points for each station of the Weather Bureau, as deduced from observations made at 8 a. m. and 8 p. m., daily, are given in Table I.

The *rate of evaporation* from a special surface of water on muslin at any moment determines the temperature of the wet-bulb thermometer, but a properly constructed evaporimeter may be made to give the *quantity* of water evaporated from a similar surface during any interval of time. Such an evaporimeter, therefore, would sum up or integrate the effects of those influences that determine the temperature as given by the wet bulb; from this quantity the *average humidity of the air* during any given interval of time may be deduced.

Measurements of evaporation within the thermometer shelters are difficult to make so as to be intercomparable at temperatures above and below freezing, and may be replaced by computations based on the wet-bulb temperatures. The absolute amount of evaporation from natural surfaces not protected from wind, rain, sunshine, and radiation, are being made at a few experimental stations and will be discussed in special contributions.

*Sensible temperatures.*—The sensation of temperature experienced by the human body and ordinarily attributed to the condition of the atmosphere depends not merely on the temperature of the air, but also on its dryness, on the velocity of the wind, and on the suddenness of atmospheric changes, all combined with the physiological condition of the observer. A complete expression for the relation between atmospheric conditions and nervous sensations has not yet been obtained.

#### PRECIPITATION.

[In inches and hundredths.]

The *distribution of precipitation* for the current month, as determined by reports from about 2,500 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III. The total precipitation for the current month was heaviest over small regions in Florida, North and South Carolina, Tennessee, Virginia, eastern Pennsylvania, West Virginia, western Pennsylvania, Indiana, Illinois, Iowa, and northern Missouri, in all of which totals of 10 inches or more were reported. It was least, viz, inappreciable, over the greater part of California, Washington, and Oregon, and was less than 1 inch nearly everywhere in Nevada, Idaho, and western Montana. The larger values at regular stations were: Louisville, 13.0; Mobile and Tampa, 12.3; Parkersburg, 11.5; Kittyhawk, 10.0.

Details as to *excessive precipitation* are given in Tables XII and XIII.

The *diurnal variation*, as shown by tables of hourly means of the total precipitation, deduced from self-registering gauges kept at the regular stations of the Weather Bureau, is not now tabulated.

The *current departures* from the normal precipitation are given in Table I, which shows that precipitation was in excess in the Ohio Valley and the interior of the Atlantic States. It was deficient in the lower Mississippi and Arkansas valleys, the upper Lake Region, Washington, and Oregon. The large excesses were: Louisville, 9.2; Parkersburg, 7.1; Hannibal, 6.3; Columbus, Ohio, 6.2; Concordia, 6.1; Springfield, Ill., and Mobile, 5.8; Pensacola, 5.0. The large deficits were: Port Eads, 6.7; Meridian, 5.8; Vicksburg, 3.8; Fort Smith, 3.7; New Orleans, 3.6.

The *average departure* for each district is also given in Table I. By dividing these by the respective normals the following corresponding percentages are obtained (precipitation is in excess when the percentages of the normals exceed 100):

Above the normal: New England, 106; middle Atlantic,